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| 10/813,409 | 03/29/2004 | Ga-Lane Chen | | 4779 |

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WEI TE CHUNG
FOXCONN INTERNATIONAL, INC.
1650 MEMOREX DRIVE
SANTA CLARA, CA 95050

| EXAMINER | |
|---|---|
| BAND, MICHAEL A | |

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| 1753 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/813,409 | CHEN, GA-LANE | |
| | Examiner | Art Unit | |
| | Michael Band | 1753 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *09 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Arguments*

1. With respect to the objection of the specification, Applicant has appropriately amended without adding new material. Therefore the objection is withdrawn.

2. Applicant's arguments, see pages 7-12, filed July 9, 2007, with respect to the rejections of claims 1-15 under 35 U.S.C. 103(a) have been fully considered and are persuasive due to amended independent claims of sequential sputtering of targets. Therefore, the rejections have been withdrawn. However upon further consideration, a new grounds of rejection is made below in view of Beck et al (US Patent No. 6,518,086), Heeks et al (US Patent No. 6,559,593), Wickersham, Jr. et al (US Patent No. 7,087,142), and Kobayashi (Japanese Patent No. 63270452).

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> **The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.**

4. Claims 6 and 19 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. A voltage range between 200 and 900 volts and a power density range of 20 and 60 W/cm$^2$ are disclosed (specification, p. 6, para 0015). Claims 6 and 19 claim a voltage range between 200 and 1000 volts or between 600 and

1000 volts, respectively. Claims 6 and 19 also claim a power density range between 20 and 70 W/cm$^2$. These ranges are not provided in the disclosure.

### *Claim Rejections - 35 USC § 102*

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> **A person shall be entitled to a patent unless –**
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 5, 7, 9, 11, and 15-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Beck et al (US Patent No. 6,518,086).

With respect to claims 1 and 15, Beck '086 discloses a method of producing thin-films of group IB-IIIA-VIA on a substrate in a vacuum for use in photovoltaic applications (i.e. electrically conductive) (abstract). Beck '086 further discloses a preferred method of DC magnetron sputtering incorporating specially designed shields and sputter guns to prevent group VIA (e.g., Se) poisoning of the group IB (e.g., Cu) and group IIIA (e.g., Ga, In, or In-Ga) targets in the sputtering apparatus (col. 7, lines 15-25), thus a plurality of target modules are used in the sputtering apparatus. It is well known that Se, Cu, Ga, and In have electrical properties and are thus electrically conductive. Beck '086 also discusses using argon in the sputtering process (col. 8, lines 25-33). It is also inherent that a DC sputtering magnetron has a voltage applied to a target (i.e. cathode) as evidenced by Love et al (US Patent No. 4,465,575; col. 17, line 37) which is referenced by Beck '086 (col. 7, lines 15-17). Beck '086 further discloses coating a substrate by

sequential deposition of a group IIIA-VIA followed by deposition of a group IB-VIA by sputtering (col. 7, lines 6-13), thus a plurality of electrically conductive layers are formed on the substrate from multiple targets.

With respect to claims 2 and 16, Beck '086 further discloses that the vacuum is $10^{-7}$ Torr to $10^{-5}$ Torr (col. 10, lines 1-5).

With respect to claims 3 and 17, Beck '086 further discloses using a sputter pressure of 10 mTorr ($10^{-2}$ Torr) argon (col. 15, lines 39-41).

With respect to claim 5, Beck '086 further discloses a DC magnetron sputtering is used to sputter the targets (col. 7, lines 15-24), thus a DC (i.e. direct current) power source is used.

With respect to claim 7, Beck '086 further discloses electrically conductive layers composed of copper, indium, and gallium (col. 7, lines 25-37).

With respect to claim 9, Beck '086 further discloses a target made from copper (col. 7, lines 18-30).

With respect to claim 11, Beck '086 further discloses a composite target composed of Ga-In (col. 7, lines 20-24) or Cu-Ga (col. 15, lines 29-30).

***Claim Rejections - 35 USC § 103***

7. Claims 4 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beck et al (US Patent No. 6,518,086) as applied to claims 1 and 15 above, and further in view of Heeks et al (US Patent No. 6,559,593)

With respect to claims 4 and 18, the reference is cited as discussed for claims 1 and 15. However Beck '086 is limited in that while it discusses an inert (i.e. argon) gas being injected into the apparatus, a specific flow rate is not suggested.

Heeks '593 teaches a method of sputter deposition onto an organic material (i.e. substrate resin) using a discharge gas (abstract), with the discharge gas being either argon or neon (col. 2, lines 31-35). Heeks '593 further teaches that the target could comprise a metal or metal alloy, with the metals being copper (Cu) or indium (In) (col. 3, lines 2-10). Heeks '593 describes a sputtering apparatus using DC magnetron sputtering where the discharge gas, either argon or neon, has a flow rate of 25 sccm (col. 5, lines 25-35 and line 60).

It would have been obvious to one of ordinary skill in the art to apply the known technique of using an inert, working gas (i.e. argon) at a specific flow rate to sputter a substrate taught in Heeks '593 to improve the sputtering magnetron apparatus of Beck '086 for the predictable result of a specific concentration of generated plasma and metal ions sputtered onto a substrate.

8. Claims 6 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beck et al (US Patent No. 6,518,086) as applied to claims 1 and 15 above, and further in view of Wickersham, Jr. et al (US Patent No. 7,087,142).

With respect to claims 6 and 19, the reference is cited as discussed for claims 1 and 15. However Beck '086 is limited in that while it is inherent to bias the target and therefore have a power density present, neither a specific target voltage nor power density is suggested.

Wickersham '142 teaches generating an argon plasma magnetically contained via DC magnetron (col. 5, lines 40-50) with a target composed of a Cu-Al alloy (col. 3, lines 58-63) for sputtering onto a substrate. Wickersham '142 further teaches a power density range from 8 W/cm$^2$ to 60 W/cm$^2$ using this DC magnetron sputtering apparatus (col. 5, lines 40-47). Furthermore, Wickersham '142 describes in Table 1 the sputtering voltage and power densities used in the apparatus, where the voltages are between 405 volts and 503 volts with accompanying power densities (Table 1, col. 5-6).

It would have been obvious to one of ordinary skill in the art to try the ranges of voltages and power densities of Wickersham '142 in an attempt to provide an improved power source for the apparatus of Beck '086 as a person with ordinary skill has good reason to pursue the known options within his or her technical grasp.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

9. Claims 8, 10, and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beck et al (US Patent No. 6,518,086) as applied to claims 1, 7, and 11 above, and further in view of Kobayashi (Japanese Patent No. 63270452).

With respect to claims 8 and 10, the reference is cited as discussed for claim 7. However Beck '086 is limited in that while a variety of different metals are suggested for deposition, nickel or stainless steel is not.

Kobayashi '452 teaches PVD (physical vapor deposition) magnetron sputtering a thin film onto a polymer substrate by generating a plasma near a metal target (abstract).

Furthermore, Kobayashi '452 discusses using a variety of metals incorporated as targets, including aluminum (Al), copper (Cu), titanium (Ti), indium (In), tellurium (Te), selenium (Se), nickel (Ni), chromium (Cr), and iron (Fe) (abstract). Also discussed as possible target materials are metallic or semimetallic compounds (abstract). It is well known that stainless steel is comprised of iron and chromium (i.e. metallic compound). Kobayashi '452 cites the advantage of using these materials as superior adhesion of film layers to the substrate in addition to reduction in mechanical stresses due to differences of thermal expansivity between the substrate and metal (abstract).

It would have been obvious to one of ordinary skill in the art to incorporate the metals and metallic compounds taught in Kobayashi '452 as the target materials in Beck '086 in order to gain the advantages of superior adhesion of films to the substrate and reduction in mechanical stress.

With respect to claim 12, the references are cited as discussed for claim 11. However Beck '086 is limited in that while copper and other electrically conductive materials are used as distinct target components, nickel and stainless steel are not specified.

Kobayashi '452 teaches PVD (physical vapor deposition) magnetron sputtering a thin film onto a polymer substrate by generating a plasma near a metal target (abstract). Furthermore, Kobayashi '452 discusses using a variety of metals incorporated as targets, including aluminum (Al), copper (Cu), titanium (Ti), indium (In), tellurium (Te), selenium (Se), nickel (Ni), chromium (Cr), and iron (Fe) (abstract). Also discussed as possible target materials are metallic or semimetallic compounds (abstract). It is well

known that stainless steel is comprised of iron and chromium (i.e. metallic compound). Kobayashi '452 cites the advantage of using these materials as superior adhesion of film layers to the substrate in addition to reduction in mechanical stresses due to differences of thermal expansivity between the substrate and metal (abstract).

It would have been obvious to one of ordinary skill in the art to incorporate the metals and metallic compounds taught in Kobayashi '452 as the target materials in Beck '086 in order to gain the advantages of superior adhesion of films to the substrate and reduction in mechanical stress.

With respect to claims 13 and 14, the reference is cited as discussed for claim 11. Beck '086 further discloses how the substrate should be of sufficient thickness to provide mechanical support to the film (col. 6, lines 11-15). Beck '086 also states suitable substrates are glass, stainless steel, metal foils, high temperature plastics, ceramic, and silicon (col. 6, lines 14-19). However Beck is limited in that while it is discussed to use high temperature plastics, it is not suggested that the substrate be a resin nor specified the composition of the substrate.

Kobayashi '452 teaches Kobayashi '452 teaches PVD (physical vapor deposition) magnetron sputtering a thin film onto a polymer substrate by generating a plasma near a metal target (abstract). In addition, Kobayashi '452 states that the substrate is a polycarbonate resin or epoxy resin (abstract), both of which are known thermoplastics (i.e. high temperature plastics). Polycarbonate is a similar in nature to a glycol-modified polyester which is a liquid crystal polymer and encompasses polyethylene terephthalate, as evidenced by www.wikipedia.com (Documents U and V

of PTO-892, filed 7-31-2007). Kobayashi '452 cites the advantage of using these materials as superior adhesion of film layers to the substrate in addition to reduction in mechanical stresses due to differences of thermal expansivity between the substrate and metal (abstract).

It would have been obvious to one of ordinary skill in the art to use a polycarbonate resin taught in Kobayashi '452 as the substrate material in Beck '086 in order to gain the advantages of superior adhesion of films to the substrate and reduction in mechanical stress.

***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 6,593,150; US Patent No. 6,585,870; US Patent No. 4,923,585; US Patent No. 4,465,575 as being related to the state of the art.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAB

ALEXA D. NECKEL
SUPERVISORY PATENT EXAMINER